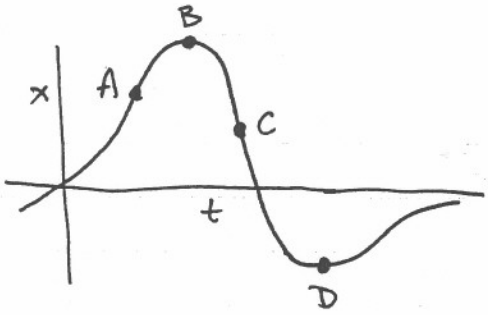
Physics 131 – HW I Solutions

1



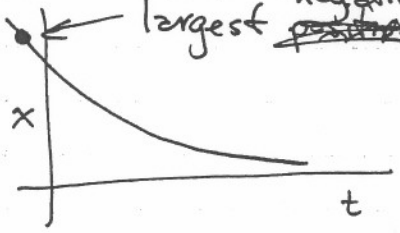
A: largest pos. velocity

C: largest neg. velocity

B&D: zero velocity

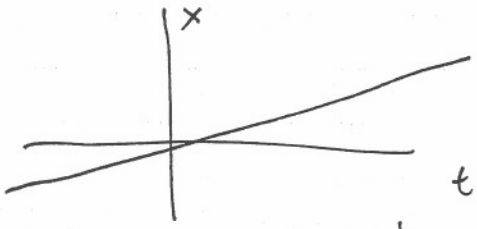
(One might also argue there is another zero velocity point at the far right – hard to tell from the graph.)

2

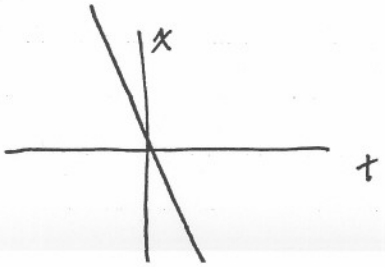


This graph has no positive or zero velocity regions, although it seems to tend to zero velocity at large times.

3 A small positive constant velocity – a straight line with a small positive slope – for example

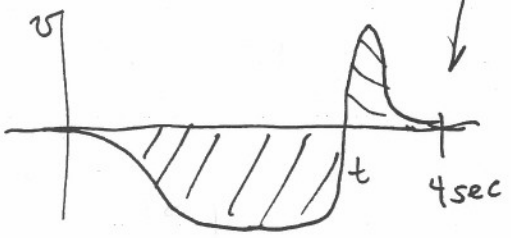


A large negative const veloc – line w/ large neg slope – for ex.:



I left out 4 sec mark— sorry!

4

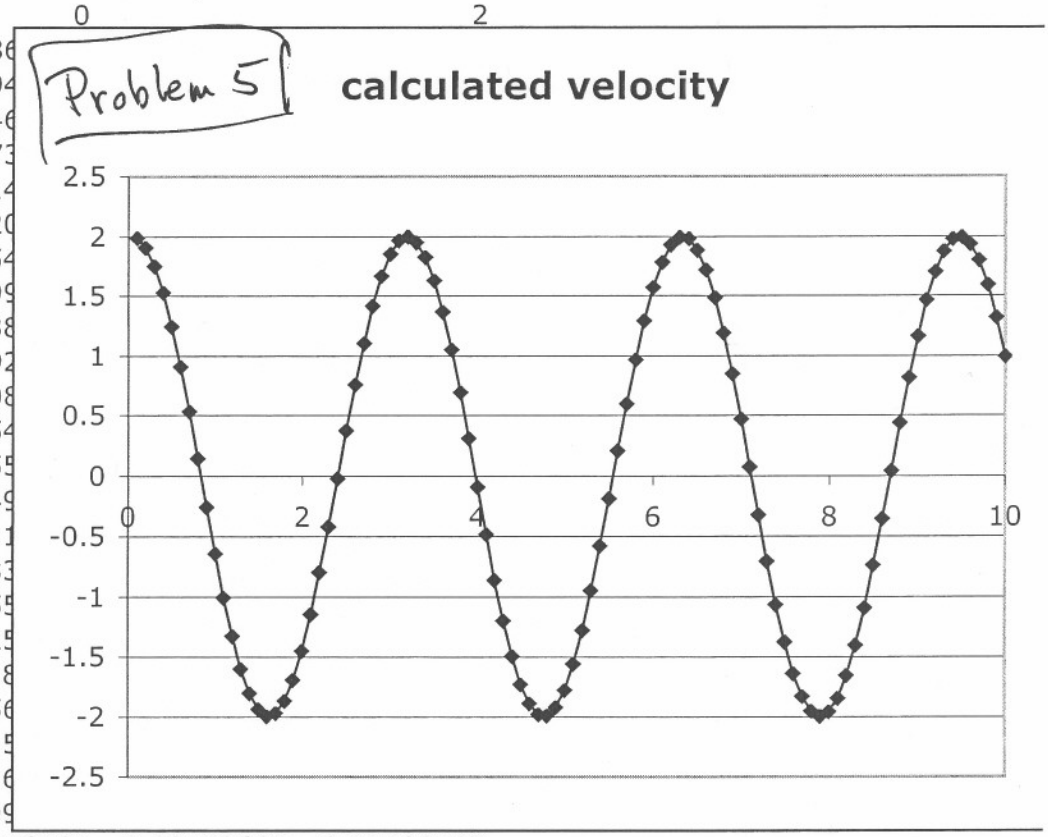


Net displacement is integral of $v(t)$ graph — or total area under curve. Area under axis counts as negative, area above, positive.

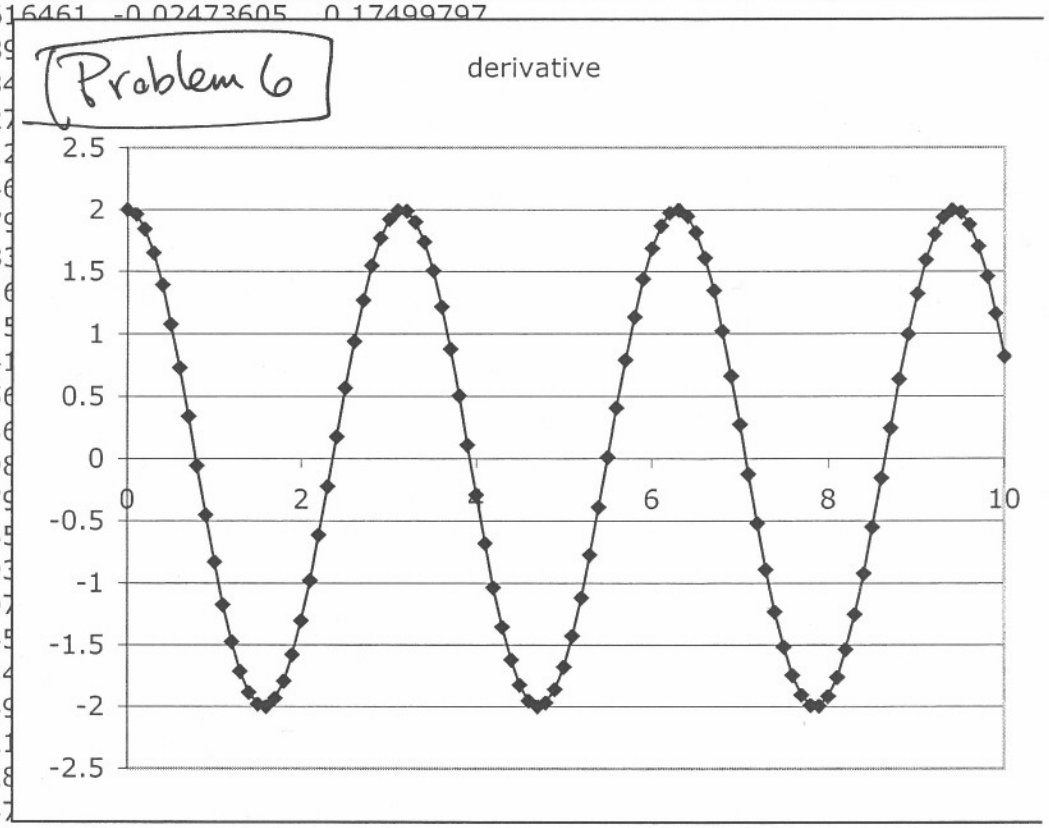
So in this case, net area is negative, implying a negative Δx between 0 and 4 sec. In other words - final position is smaller (or more negative) at $t=4$ than at $t=0$

time	position	velocity	derivative
0		0	2
0.1	0.1986		
0.2	0.3894		
0.3	0.5646		
0.4	0.7173		
0.5	0.8414		
0.6	0.9320		
0.7	0.9854		
0.8	0.999		
0.9	0.9738		
1	0.9092		
1.1	0.808		
1.2	0.6754		
1.3	0.5155		
1.4	0.3349		
1.5	0.1411		
1.6	-0.0583		
1.7	-0.255		
1.8	-0.4425		
1.9	-0.6118		
2	-0.756		
2.1	-0.8715		
2.2	-0.9516		
2.3	-0.99		
2.4	-0.9961	-0.02473605	0.17499797
2.5	-0.9589		
2.6	-0.8834		
2.7	-0.7727		
2.8	-0.6312		
2.9	-0.4646		
3	-0.279		
3.1	-0.083		
3.2	0.116		
3.3	0.3115		
3.4	0.4941		
3.5	0.656		
3.6	0.7936		
3.7	0.898		
3.8	0.9679		
3.9	0.9985		
4	0.9893		
4.1	0.9407		
4.2	0.8545		
4.3	0.734		
4.4	0.5849		
4.5	0.4121		
4.6	0.2228		
4.7	0.0247		

Problem 5

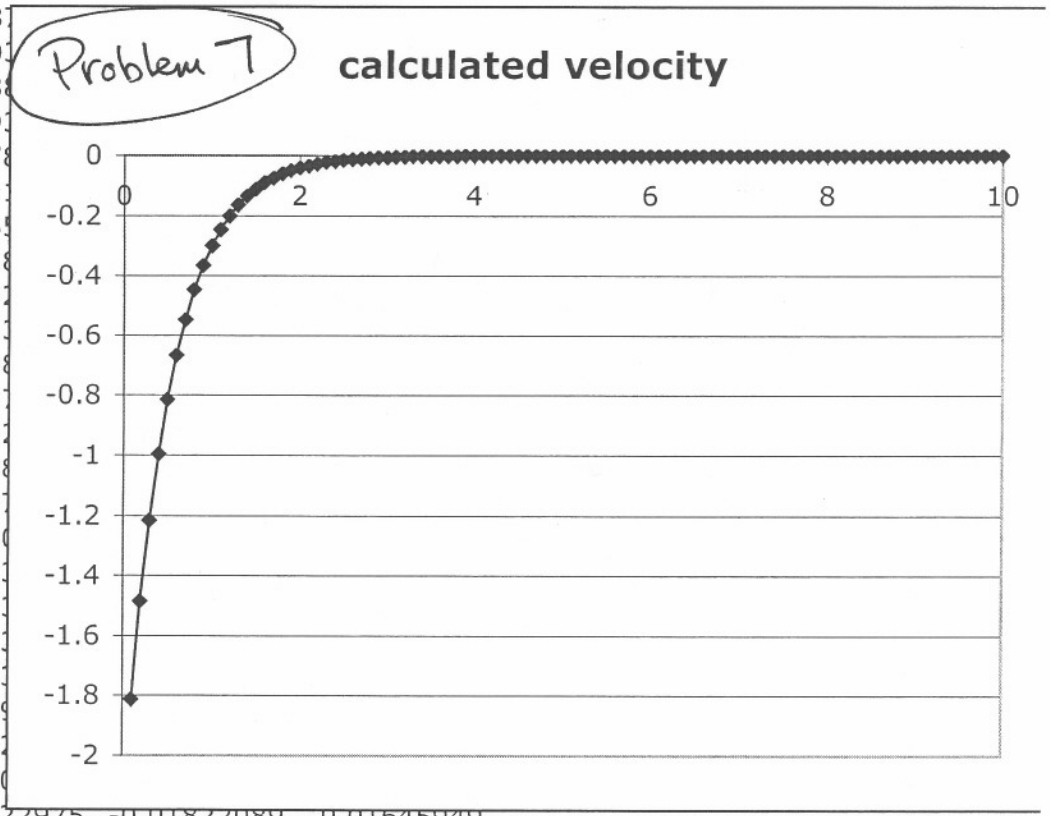


Problem 6

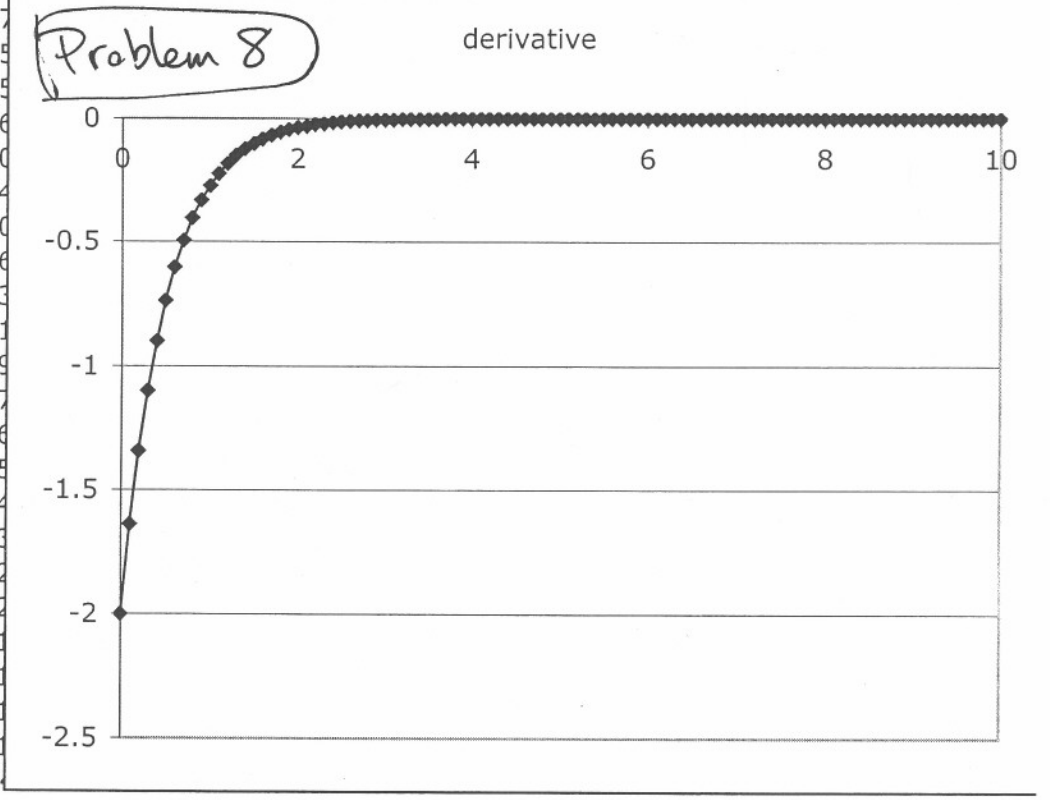


time	position	velocity	derivative
0		1	-2
0.1	0.818		
0.2	0.670		
0.3	0.548		
0.4	0.449		
0.5	0.367		
0.6	0.301		
0.7	0.246		
0.8	0.201		
0.9	0.165		
1	0.135		
1.1	0.110		
1.2	0.090		
1.3	0.074		
1.4	0.060		
1.5	0.049		
1.6	0.040		
1.7	0.033		
1.8	0.027		
1.9	0.022		
2	0.018		
2.1	0.014		
2.2	0.012		
2.3	0.010		
2.4	0.008		
2.5	0.006		
2.6	0.005		
2.7	0.004		
2.8	0.003		
2.9	0.003		
3	0.002		
3.1	0.002		
3.2	0.001		
3.3	0.001		
3.4	0.001		
3.5	0.000		
3.6	0.000		
3.7	0.000		
3.8	0.000		
3.9	0.000		
4	0.000		
4.1	0.000		
4.2	0.000		
4.3	0.000		
4.4	0.000		
4.5	0.000		
4.6	0.000		
4.7	8.272		

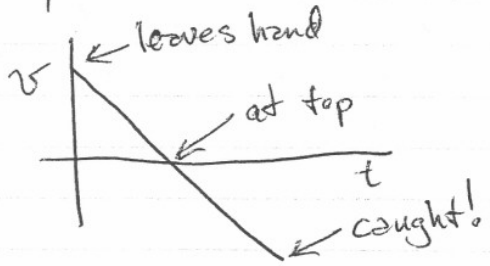
Problem 7



Problem 8

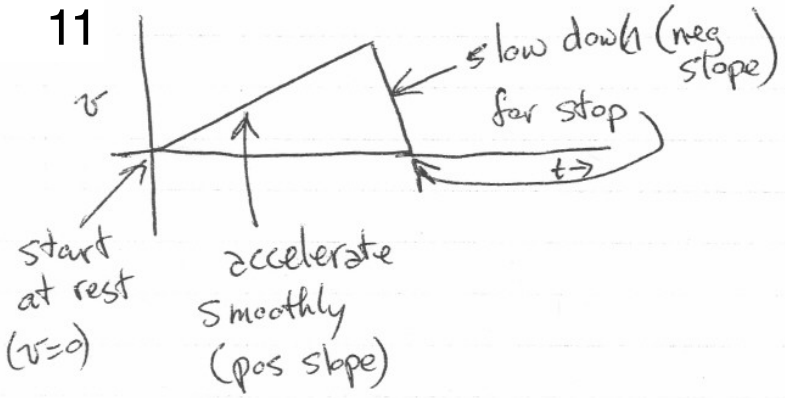


9 Largest positive velocity is just as it leaves your hand. The largest [magnitude] negative velocity is just before you catch it. The smallest magnitude velocity is zero at the top. The velocity decreases uniformly with time:

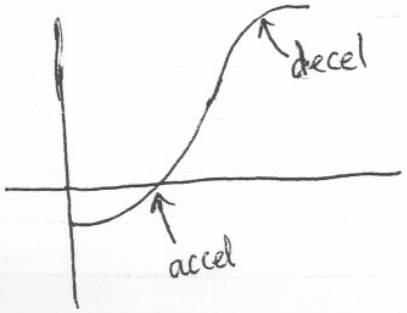


10 Moving $-2\ m/s$ for 10 sec gives a displacement of $\Delta x = vt$ or $\Delta x = -20\ m$. So if initially at $x = +3\ m$, it ends up at $x = (+3 - 20)\ m = \boxed{-17\ m}$

11



So, one possible $x(t)$ is



12 a) We found a is the slope of the $v(t)$ graph,

or $a = \frac{\Delta v}{\Delta t} = \frac{60\,\text{mph}}{10\,\text{sec}} \approx \frac{26.8\,\text{m/s}}{10\,\text{s}} = \boxed{2.68\,\text{m/s}^2}$

b) Assuming v at start is zero, $\Delta x = \frac{1}{2}at^2$, so

$$\Delta x = \frac{1}{2} \cdot 2.68\,\text{m/s}^2 \cdot (10\,\text{sec})^2 = 1.34 \times 100\ \text{m} = \boxed{134\,\text{m}}$$